

THURSDAY, JULY 29, 1886

*ELECTRIC TRANSMISSION OF ENERGY**Electric Transmission of Energy.* By Gisbert Kapp, C.E. (London: Whittaker and Co., 1886.)

SINCE the invention of the electric telegraph the subject of the electric transmission of energy is that subject which of all others has most attracted the attention of practical scientific men. Under this head are comprehended every form of telegraph and of telephone, electric railways, and the electric transmission of power for the driving of lathes and other machines. Even the novel apparatus which has been described for enabling us to see what is happening at distant places and the very transmission of light itself through the interstellar ether must be regarded as parts of the great subject which Mr. Kapp has undertaken to treat of in this small volume. On examining the book, however, it will be found that the author has wisely confined his attention to the electric transmission of energy for the purpose of its being transformed at a distant place into mechanical energy for driving machinery. Indeed, it may be said that much more than half the book is devoted to the subject of the dynamo-machine, and that much less than half of it is devoted to the subject of the electric transmission of energy. Before electric energy can be transmitted it is necessary to produce it. It is rather difficult to imagine a store of electric energy existing anywhere and ready for transmission; and hence its production, transmission, and transformation into some other form of energy are circumstances which are exactly coincident with one another: as its transmission therefore implicitly involves its production and transformation, Mr. Kapp is perfectly justified in devoting as much of his book as he pleases to a description of the dynamo-machine.

Few people are better qualified to speak from experience of the most recent practice in the manufacture of dynamo-machines than the author of this book, and his paper entitled "Modern Continuous-Current Dynamo-Electric Machines and their Engines," read on November 24, 1885, before the Institution of Civil Engineers, and the discussion upon it, are to be regarded as exceedingly valuable helps to the electrical engineer. This book will be valuable to students who do not possess a copy of Mr. Kapp's original paper. It contains additional matter, much of it good; but to some of it we would offer a mild objection. For example, some distinction might have been made between the magnetic theories of Weber and Prof. Hughes. Mr. Kapp has certainly a good working knowledge of the theory of the dynamo-machine, and he leads up to the theory in a very ingenious way, but we are afraid that students will benefit more by reading an elementary treatise on electricity and magnetism, the writer of which may have had less originality than Mr. Kapp, than by taking their elementary notions from this book. Thus, for example, the following statement may have a perfectly orthodox meaning to Mr. Kapp:—"We can either assume that the lines are of different strength, and that the mechanical force with which a given free magnet pole is urged along any one particular line, is dependent on the strength of that line, which may be

different from that of any other line belonging to the same field" (p. 18); but it will give great trouble to a student who knows that the resultant force is not the same at all points in a line of force, and who will find it inconsistent with the statements which Mr. Kapp has himself to make later on.

Again, we are disposed to think that it would be graceful in Mr. Kapp, and other makers of dynamo-machines at the present time, to give a little more credit to Gramme, and to refrain from dwelling so much on the great advances which have been made in recent years in the construction of dynamo-machines. When we compare modern machines with the Gramme machine of ten years ago, we see improvements on the original machine certainly, but they are very small. They consist mainly in ways of winding the conductor on the armature, so that it shall not readily slip or heat. How little of an essential kind has been introduced in the field-magnet arrangement may be gathered from the sheet of diagrams given at p. 102 of this book. In fact, a modern dynamo-machine may be said to be a Gramme or Siemens machine, the field-magnet circuit of which has been modified in a fanciful manner. Happily such modification in shape, however fanciful, does not seem to have impaired very much the efficiency of the arrangement, whereas it has enabled makers to greatly alter the outside appearances of machines, so that good Gramme and Siemens dynamo-machines are no longer called by these names, but by the names of the makers who have given them such various outside appearances. Large modern machines are superior to ancient small machines in efficiency and in the "output" per pound weight: firstly, because they are larger—and this is the main cause of their superiority; secondly, because the mechanical engineers to whom the details in construction have always been intrusted are now, some of them, slightly acquainted with the laws of electricity and magnetism; and, thirdly, because the manufacture of numerous machines has enabled costly manufacturing tools to be introduced, and these tools enable a method of construction to be employed which would in the past have been prohibited by the expense.

Again, we object somewhat to Mr. Kapp's use of the terms "theoretical" and "practical." For example, in discussing the efficiency of the electromotor when doing various amounts of work, at p. 129, he says that a certain statement which he has made is theoretically quite accurate, but from a practical point of view it requires some modification, and he proceeds to show that the want of accuracy was due to the fact that all considerations of magnetic and material friction had been neglected. We should have said in such a case that the statement was theoretically quite inaccurate. We consider that much mischief is occasionally done by what is usually called the comparison of theory and practice. If the mathematical results derived from some hypothesis which is evidently wrong be called a theory, we must of course have disagreement between theory and practice, and it is greatly in consequence of this that the majority of practical engineers have acquired a contempt for theory and for the reading of books which deal with the theoretical principles underlying their professional work. If the results of speculation on absurd hypotheses must be

compared with facts, the terms to be used are "hypothetical" and "practical."

This is one of three advertised books of "The Specialists' Series" which deal with electric engineering. Another of the three is devoted to the subject of magneto- and dynamo-electric machines, and the third is on electric lighting. We think it probable that in the greater part of Mr. Kapp's book he is going over ground which belongs almost altogether to the author of one of the other books of the series. As Mr. Kapp treats his subjects well, however, we cannot much object to this; but what we do object to is, that while taking up the subjects of the other authors, he has not given us his own subject. In sixty-three pages, or about one-fifth of the book, an instructive account is given of the various attempts which have been made to drive carriages on railways, telpher lines, ploughs, cranes, fans, and pumps, and we understand from Mr. Kapp's introduction that it is to this sort of transmission of energy that his book is devoted.

Now it is not merely sufficient for the author to give an account of what has already been done in this way; the reader expects a correct theoretical treatment of the whole subject, the cost of conductors, the fall of potential along the conductor, and the efficiency of transmission. These questions are sufficiently well taken up for a treatise on electric lighting, but for a book on the electric driving of machines at a distance the subject can hardly be said to be touched upon. Thus, for example, the development of Sir William Thomson's law as applied in electric light installations, and published by Prof. Forbes in his lectures at the Society of Arts, is carefully given. Now small alteration of potential difference at an incandescent lamp may produce disastrous effects on the lamp, may destroy it, or may cause sudden darkness, and this is the most important consideration in arranging conductors for lighting purposes; whereas, in the electric driving of trains or machinery, small alterations of potential difference are of no importance whatsoever. In consequence of this, in driving machinery electrically there may be a very considerable fall of potential along the conductor from the dynamo to the motor, and hence motors may be worked directly at distances which it would be absurd to contemplate in working an incandescent lamp. In fact the question of cost of conductors must be treated from quite a different point of view in the two cases, and it seems to us that Mr. Kapp has taken up the point of view which is most remote from his subject.

We think Mr. Kapp's book a very valuable addition to electrical engineering literature. It will be widely read, and it deserves the popularity which it will receive. Had we not thought it to be so excellent in many ways we should not have criticised it so narrowly, and, in spite of our warning to the student, we are very glad to meet with originality in leading up to the theory of the dynamo-machine. We are glad to see that the author has slightly amplified his account of the method, now in general use, of calculating the probable electromotive force of a dynamo-machine, which he published in his paper. The method is known to be practically correct, although it is based on a magnetic hypothesis of which there is no recognition in any book on physics—the hypothesis of magnetic resistance. We could have wished that Mr. Kapp had dwelt more upon this hypo-

thesis, as we know of no actual results of experiment having yet been published which give it a general verification.

In reading over this criticism we feel that our objections to the book have all been brought very prominently forward. It would be very easy to point out here much that is good in the book, but perhaps our readers would then find this article long and tedious. Any reader of the book will find original and interesting views in every chapter; it is not every reader who would for himself have noticed the faults which we have here gathered together. We have achieved the difficult task of finding fault with an excellent book.

JOHN PERRY

OUR BOOK SHELF

The Aryan Maori. By Edward Tregear. (Wellington, N.Z.: George Didsbury, 1885.)

THIS little book contains a theory that the ancestors of the New Zealanders belonged to the Aryan race, and were a pastoral people. To signify this, the cover is adorned with a golden picture, seemingly representing a Maori warrior in native guise, accompanied by a sturdy little Highland bull. Now, it being notorious that the New Zealanders, when discovered, had no cattle nor remains of them in their country, the reader's curiosity is aroused to see how Mr. Edward Tregear supports this unlikely thesis. His method proves to be a philological paradox which we have never met with before. For example, it is argued (p. 31) that the Maoris once knew the bull by a word like the latin *taurus*, a bull. How so, one asks, when they no more had the word in their vocabulary than the beast on their land? The answer is, that in the absence of the word *taurus* itself the author relies on a dozen or so of other Maori words which he alleges to refer to it. The following are a few of them:—*Tara*, had courage; *tararau*, made a loud noise; *tararua*, had two points or peaks; *tareha*, was red; *tarehu*, caught one unawares; *tarore*, had a noose put on him; *taruke*, lay dead in numbers (if it was characteristic of the bulls to lie dead in numbers, how multitudinous the cows and calves must have been in the Aryan-Maori herds!). The poverty of the Maori language in consonants makes it easy to the author to play this fanciful game with his dictionary to his own full satisfaction. He takes a real interest in studying the Maoris, and though he has gone astray this time, he may, if a young man, do something more worth doing in the collection of native customs, legends, games, and the like which the older natives still remember.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]
[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

Tidal Friction and the Evolution of a Satellite

IN NATURE, vol. xxxiii. p. 367, is an article by Mr. G. H. Darwin, defending his theory of tidal evolution, and dealing with what I have written respecting that theory. Space will here prevent my replying at length to the above; but as the author of it seems to think that my inquiry has been confined too much to the mode of origin of the moon, I have pushed it out in other directions, when important results have been obtained. I purpose here chiefly devoting my space to these, which can be put in a comparatively short and simple form.